What is claimed is:

1. A method for spatially resolved spin resonance detection in a sample, the method comprising:

providing an input/output signal coupler, having at least one pair of degenerate orthogonal modes, an x-axis, an orthogonal y-axis and an evanescent signal-emitting probe, located on and connected to the x-axis adjacent to a selected sample of material;

providing a selected magnetic field at a selected portion of the sample;

providing, along the x-axis, an input signal, having a selected frequency f_{in}; that is equal to a frequency associated with a degenerate resonant mode for the coupler, where the input signal produces an evanescent signal at the probe;

allowing the input signal and the magnetic field to interact with at least one spin for at least one atomic constituent in the sample and to thereby produce an output signal representing interaction of the evanescent signal and the magnetic field with the at least one spin and having an output signal component with the frequency f_{in}; and

sensing a non-zero portion of the output signal along the y-axis of the coupler.

2. The method of claim 1, further comprising adjusting at least one parameter of said coupler so that, when said sample is absent, a magnitude of said output signal received along said y-axis of said coupler is minimized.

3. The method of claim 1, further comprising providing as said coupler a planar, substantially square signal coupler, having an x-axis conductor component along and a y-axis conductor component and having a length of substantially $n\lambda/2$ on each side of said conductor, where λ is a selected wavelength and n is a selected non-zero integer.

4. The method of claim 3, further comprising generating said evanescent signal at said probe using an electrically conducting loop connected between said x-axis conductor component and a ground potential source for said coupler and choosing said integer n to be an even integer.

5. The method of claim 3, further comprising choosing said probe to be a tip and choosing said integer n to be an odd integer.

6. The method of claim 3, further comprising selecting said wavelength λ to be equal to c'/f_{in}, where c' is a velocity of electromagnetic wave propagation in said conductor component.

7. The method of claim 1, further comprising providing as said coupler a planar, substantially circular coupler, having an x-axis conductor component and a y-axis conductor component and having a diameter of substantially $n\lambda/2$, where λ is a selected wavelength.

8. The method of claim 7, further comprising generating said evanescent wave at said probe using an electrically conducting loop connected between said x-axis center conductor and a ground potential source for said coupler and choosing said integer n to be an even integer.

9. The method of claim 7, further comprising choosing said probe to be a tip and choosing said integer n to be an odd integer.

10. The method of claim 7, further comprising selecting said wavelength λ to be equal to c'/f_{in}, where c' is a velocity of electromagnetic wave propagation in said conductor component.

11. The method of claim 1, further comprising providing said magnetic field at a time contemporaneous with a time said input signal is provided at said sample.

12. The method of claim 1, further comprising providing as said magnetic field a substantially static field.

13. The method of claim 1, further comprising providing as said magnetic field a time varying field having a frequency that slowly varies over a selected frequency range including at least one magnetic resonance frequency for said sample.

14. The method of claim 1, further comprising sensing said non-zero portion of said output signal using a low noise amplifier to amplify said non-zero portion.

15. A method for spatially resolved spin resonance detection in a sample, the method comprising:

providing an input/output signal coupler, having an evanescent signal-emitting probe, located adjacent to a selected sample of material, and having at least one node point for an input signal having a selected evanescent signal frequency f_{in} with the sample absent;

providing a selected magnetic field at a selected portion of the sample;

providing an input signal with the frequency f_{in} at the coupler, where the input signal produces an evanescent signal at the probe;

allowing the input signal and the magnetic field to interact with at least one spin for at least one atomic constituent in the sample and to thereby produce an output signal representing interaction of the evanescent signal and the magnetic field with the at least one spin and having an output signal component with the frequency f_{in}; and

sensing a non-zero portion of the output signal at the node point of the coupler.

16. The method of claim 15, further comprising adjusting at least one parameter of said coupler so that, when said sample is absent, a magnitude of said output signal received at said node point of said coupler is minimized.

17. The method of claim 15, further comprising providing said magnetic field at a time contemporaneous with a time said input signal is provided at said sample.

18. The method of claim 15, further comprising providing as said magnetic field a substantially static field.

19. The method of claim 15, further comprising providing as said magnetic field a time varying field having a frequency that slowly varies over a selected frequency range including at least one magnetic resonance frequency for said sample.

20. The method of claim 15, further comprising sensing said non-zero portion of said output signal using a low noise amplifier to amplify said non-zero portion.

21. A method for spatially resolved spin detection in a sample, the method comprising:

providing first and second, substantially identical resonators, where the first resonator is connected to an evanescent signal-emitting probe and is adjacent to a selected sample of material;

providing a selected magnetic field at a selected portion of the sample;

providing, along the first and second resonators, an input signal having a selected frequency f_{in} that produces an evanescent signal at the probe;

allowing the evanescent signal and the magnetic field to interact with at least one spin for at least one atomic constituent in the sample and to produce an output signal having an output signal component with the frequency f_{in}; and

forming a difference of signals sensed in the first and second resonators to thereby sense an output signal representing interaction of the evanescent signal and the magnetic field with the at least one spin.

22. The method of claim 21, further comprising providing first and second electromagnetic shields for said respective first and second resonators adjacent to said sample, and providing a small aperture in the first shield to expose said sample to said probe.

23. The method of claim 21, further comprising permitting said probe to extend through said first shield aperture.

24. The method of claim 21, further comprising providing each of said first and second resonators with a length of substantially $n\lambda/2$, where λ is a selected wavelength and n is a selected integer.

25. The method of claim 24, further comprising selecting said wavelength λ to be equal to c'/f_{in}, where c' is a velocity of electromagnetic wave propagation in said first and second resonators.

26. The method of claim 21, further comprising generating said evanescent signal at said probe using an electrically conducting loop connected between said first resonator and a ground potential source for said first resonator and choosing said integer n to be an even integer.

27. The method of claim 21, further comprising choosing said probe to be a tip and choosing said integer n to be an odd integer.

28. The method of claim 21, further comprising providing said magnetic field at a time contemporaneous with a time said input signal is provided at said sample.

29. The method of claim 21, further comprising providing as said magnetic field a substantially static field.

30. The method of claim 21, further comprising providing as said magnetic field a time varying field having a frequency that slowly varies over a selected frequency range including at least one magnetic resonance frequency for said sample.

31. The method of claim 21, further comprising sensing at least one of said first and second resonator signals using a low noise amplifier.

32. A method for spatially resolved spin detection in a sample, the method comprising:

providing a selected magnetic field at a selected portion of a material sample;

providing an evanescent signal having a selected frequency f_{in} at a probe located adjacent to the sample;

directing a laser signal, having a selected laser frequency and having a selected polarization direction, at the sample;

allowing the magnetic field, the evanescent signal and the laser signal to interact with at least one spin for at least one atomic constituent in the sample and to produce an output signal having an output signal component with the frequency f_{in}; and

forming an output signal component having the frequency f_{in}, to thereby sense an output signal component representing interaction of the at least one spin with at least two of the magnetic field, the evanescent signal and the laser signal.

33. The method of claim 32, further comprising using said laser signal to optically pump said at least one spin and using said input signal to detect a change in at least one condition of said at least one spin.

34. The method of claim 32, further comprising using said input signal to induce a change in at least one condition of said at least one spin, forming said output signal component with a second selected polarization direction, and using said output signal to detect a change in at least one optical condition of said at least one spin.

35. The method of claim 32, further comprising choosing, as said second output signal component a fluorescence signal associated with said at least one atomic constituent.

36. The method of claim 32, further comprising directing said laser signal at said sample using a Schwartzschild optical objective.

37. The method of claim 32, further comprising adjusting at least one parameter associated with formation of said output signal component so that, when said sample is absent, a magnitude of said output signal component is minimized.

38. The method of claim 32, further comprising providing said magnetic field at a time contemporaneous with a time said input signal is provided at said sample.

39. The method of claim 32, further comprising providing as said magnetic field a substantially static field.

40. The method of claim 32, further comprising providing as said magnetic field a time varying field having a frequency that slowly varies over a selected frequency range including at least one magnetic resonance frequency for said sample.

41. The method of claim 32, further comprising sensing said non-zero portion of said output signal component using a low noise amplifier to amplify said output signal component.

42. A method for determining the presence of a selected chemical or biological molecule, the method comprising:

attaching a selected ferrimagnetic or ferromagnetic molecule to at least one selected molecule in a collection of molecules;

applying spatially resolved spin resonance detection to a selected portion of the collection, and determining if spin resonance is detected in the selected portion;

when spin resonance is detected in the selected portion, interpreting this condition as indicating that at least one of the selected molecules is present in the selected portion.

43. The method of claim 42, further comprising:

when spin resonance is not detected in said selected portion, interpreting this condition as indicating that said selected molecule is present, if at all, in a concentration that is smaller than a detection threshold for said spin resonance detection.

44. The method of claim 42, further comprising selecting said ferrimagnetic or ferromagnetic molecule from a group of molecules consisting of yttrium-iron-garnet and lithium ferrite.